Contribution ID: **37** Type: **Oral Presentation - Full Paper will be submitted**

Prospects of utilizing alternative fluxing agents for replacing fluorspar in steelmaking processes

Wednesday, 21 May 2025 09:30 (20 minutes)

Fluorspar (CaF2) is an industrial mineral which has been categorized as a critical raw material by the European Union. Fluorspar is commonly added in steelmaking processes (e.g. EAF, AOD, ladle..etc.) to lower the melting point of slags to promote the development of a liquid, fluid slag. This promotes more thorough reaction between the liquid slag and the steel, which enables lower impurity (e.g. O, S, P) concentrations in the steel to be achieved.
Substitution of fluorspar by alternative fluxing agents is one way to reduce risks stemming from the disruption of fluorspar's supply chain and to secure long-term, resilient supply of slag fluxing agents—a key to ensuring the competitiveness of the European steel industry and to maintaining the high quality of the steel produced. A decrease in fluorspar's use may also contribute to wider recycling options of steelmaking slags—by eliminating the risks of fluorine leaching which can potentially contaminate ground water.
This study presents some aspects of replacing fluorspar used in the argon-oxygen-decarburization (AOD) process with alternative fluxing agents during stainless steel production—which is the largest area of use of fluorspar in Sweden. Thermodynamic calculations which concern the changes in slag properties (liquid fraction, viscosity, MgO saturation) and steel chemistries (Al, S concentrations) when alternative flux agents are used would be presented. The findings would be compared with experimental results obtained from hot finger tests, where the degrees of refractory erosion are determined under different slag compositions containing various flux additions. The amount of fluorine leaching from the synthesized AOD slags which contain different types of fluxing agents would also be presented. Lastly, this study discusses the challenges and opportunities of replacing fluorspar with alternative fluxing agents in AOD process, which may be extended to other steelmaking processes.

Speaker Country

Sweden

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Session Classification: Impact of changed raw material mix on BOF process and secondary metallurgy

Track Classification: Impact of changed raw material mix on BOF process and secondary metallurgy